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NPIC/TSG/RED-269-70
3 November 1970

MEMORANDUM FOR: Chief, Technical Services Group, NPIC
SUBJECT : RED Inputs to Automatic Data Processing
Annex

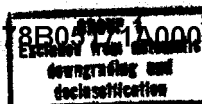
1. The major ADP functions within RED will be to provide computer systems analysis, software programs, and software maintenance in direct support of both ongoing and anticipated future Research and Development projects. Additionally, some support will be required in the selection, integration, and utilization of small, special purpose digital computers, which are integral components of some highly specialized imagery exploitation equipment being developed under several of the Research and Development programs. The NPIC requirements and primary objectives against which these programs are directed, along with additional details concerning these programs, are contained in the R&D annex. The planning schedule of work during the period FY-73-77 in each of these program areas is as follows:

Image Manipulation - It is anticipated that by early FY-73 the overall feasibility of utilizing image manipulation techniques as an operational tool for the exploitation of high resolution imagery will have been established, and work will then be concentrated on the further refinement of image manipulation techniques and upon the development of an operational, highly automated image manipulation system. The "Digital Image Manipulation Program" inherently requires an ADP system with large core storage and a large secondary storage on drum or disk. This is essential because the data array to be manipulated by the computer program ranges from a 64 x 64 array to whatever limit is imposed by NPIC's computer system core storage. A 1,024 x 1,024 array has already been used in some applications with larger arrays being highly desirable. Increasing the array size increases the core storage, secondary storage, and computer time requirements;

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however, increasing the array size also increases the size of the format of the image, which may be manipulated at one time, thereby greatly reducing overall operational processing time. Furthermore, the DIM functions are used repetitively to manipulate the image to that point where the user feels that he has achieved a maximum enhancement. These reiterations inherently require a large amount of CPU time to carry out the manipulations. RED has some reservations concerning the Univac 494's ability (as currently configured) to provide the large core and computer time requirements needed by the anticipated DIM program and still be responsive to other Center requirements. Fastran drums do provide a large amount of secondary storage, but this appears to have been mostly assigned to the IIS. There would appear to be some advantages to providing a dedicated computer for primary use in image analysis and manipulation. Alternatives obviously are to provide contract support or to affect an acceptable interface with the 494. The main point here is not so much which system is used but that this capacity must be provided in this time frame and that the system chosen must be practical in terms of the desired end result. Also associated with this task is the need for extensive programming and systems analysis. The programs required could be very time consuming.

Image Analysis - During the period FY-73-77, the impact of improved color emulsions, along with much higher resolution black and white films, will force NPIC to employ--under operational conditions--considerably more sophisticated image analysis techniques than those currently in use. Toward this end it is anticipated that extensive use of refined microdensitometric and colorimetry techniques will be required in order to reduce and analyze the large masses of data acquired thereby causing obvious increases in work load for personnel involved in developing software and providing software maintenance. Color, in particular, vastly increases the volume of measurements and data reductions required. The image analysis effort is very closely related to the image manipulation effort and, as a consequence, is subject to a number of the same constraints, al-

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ternatives, and considerations. Also considered in this category are those ADP support services required for analyzing unconventional imagery and for providing specialized processing through holographic or hybrid transformation techniques. The current emphasis on the [] program would indicate that this may be a valid area for concern. As with image manipulation, the work to be done appears to be relatively straightforward, and the technical risk would be relatively low. The major impact would be in the area of specialized software and in special equipment required to digitize the inputs, process the signals, and provide output data in useful form for interpretation.

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Image Information Technology - The major functions to be performed in this category will be to provide systems analysis and software support to the Research and Development efforts programmed under this R&D category. The major thrust will be to achieve a higher degree of automation in the handling of nondigitally recorded materials and in automating and expediting the total process, from start to finish, of producing a finished report or graphic ready for publication and dissemination. The overall objective of these efforts will be to provide more timely and efficient support to the photo interpreter while at the same time holding manpower and costs at the lowest possible levels. Computers would be involved here mainly as controllers and would, more often than not, be small units integral to the processing equipment. The only apparent alternative would be to obtain the additional services required under external contractual arrangements.

Electro Optical Imagery - By FY-73 we will have approached the "mid point" in the designing of a system for the effective exploitation of Electro Optical Imagery (EOI); and because the signal is acquired, transmitted, processed, manipulated, and perhaps viewed in a digital form, it is reasonable to expect considerable impact in the computer and computer interface areas. RED anticipates a number of computer interface problems (as yet not well defined) in

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the areas of image display devices, mensuration equipment, reproduction equipment, electronic storage devices, and image manipulation equipment. Some of these equipments will require small, integral computers, while others may be more effectively handled on line to a larger central processor. Close cooperation between AID and RED appears essential. Furthermore, we would like to take this opportunity to flag certain anticipated problem areas for AID's planning consideration. Preliminary review would indicate that there will be considerable EOI impact in the area of the "Data Base" and related IIS functions. With the arrival of the near real-time imagery, we will have a considerably changed situation. There will be a constant arrival of new information which must be rapidly inputted into the data base; conversely, collateral information must be made more rapidly available to the interpreter. With the constant and rapid input and output of EOI derived data, purging the data base will become much more critical and will have to be considerably more sophisticated. Finished information must be highly accessible and rapidly available. In the collateral area, there will be two separate problems since we will have to provide collateral information to two different groups--those involved in rapid near real-time interpretation and those involved in slower detailed read out operations. With this new emphasis on timeliness, the functions of reporting, publishing, and dissemination in a more expeditious manner will receive increased emphasis. It is further anticipated that totally new mensuration routines, allowing for the specialized nature of Electro Optical Imagery, will be required in addition to those conventional mensuration programs currently in existence or under development. Constant coordination and cooperation between AID and RED will be critical during the formative stages of the EOI Exploitation Systems and Design. Technical risk is average to high.

Imagery Interpretation Equipment - It is anticipated that, with the renewed emphasis upon timeliness inherent in a near

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real-time environment, there will be considerable pressure to expedite and automate the photo interpretation functions whether by the introduction of automatic change detection equipment, sterile imagery screening devices, or highly sophisticated photo interpretation cells where primary interpretation functions will receive some degree of semi-automation. Any approach to this type of sophistication would require some degree of computerization whether integral to the equipment or on line to the 494. The major impact is going to be in heavier investments required in systems analysis, computer software development, and software maintenance. The risk is estimated to be average, with the main anticipated problem area being interface, primarily in the areas of system integration.

R&D Management Support - With increases in the capacity and cost of R&D projects have come an ever increasing level of management scrutiny in order to obtain maximum efficiency and effectiveness from Government R&D dollars. This dictates more sophisticated management techniques on our part, which in turn requires some degree of computer support. This support would be in the form of up to 10,000 sectors of Fastran drum space in order to handle a new R&D management system currently under development. This volume of storage would be required by FY-73. The technical risk is very low.

ADP Resources - Significant ADP related resources are required by RED in order to support our R&D program and to accommodate the resultant increase in coordination with AID. These requirements would gradually increase from their present levels to a peak by mid FY-75; this is primarily related to the impact of color and EOI. In preparing this resources summary, it is assumed that it will be RED's responsibility to establish the requirements and to justify the necessary equipment and services and that AID will be responsible for the operation, space, supporting services, maintenance, etc. of the expanded ADP facility. However, it will be necessary for RED to maintain a small computer ap-

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plications section, working in close cooperation with AID, to perform the necessary interface coordination, advisory services, systems design analysis, and programming considerations in support of our own R&D efforts. By FY-73 RED will have a significant work load to warrant approximately 16 hours a week of machine time "on an open shop basis" in support of the R&D program. Initially, some [] 360/50 support will have to be obtained at ORD/DDS&T or OCS/DDS&T until approximately mid FY-73. At this time it will be necessary to provide some form of equivalent in-house capacity. The estimated monthly rental cost of a suitable system could range from approximately [] during FY-77. A breakdown of RED resource requirements by fiscal year is as follows:

a. Personnel

FY-71	One ADP Applications Supervisor	GS-14
	One Computer Science Specialist	GS-13
FY-72	As above, plus one Mathematician	GS-13
FY-73	As above, plus one Computer Programmer	GS-12
FY-74 through FY-77	(Total Compliment - 5 people)	
	One ADP Applications Manager	GS-15
	One Computer Science Specialist	GS-14
	One Mathematician	GS-13
	Two Programmers	GS-12

b. Contracts

FY-71 none
FY-72 [] for work required to format software and incorporate special sub-routines for operational use. Company unknown.

FY-73 through FY-77 none anticipated

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c. Space Requirements

FY-71 280 sq. ft.

FY-72 360 sq. ft.

FY-73 through FY-77 550 sq. ft.



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Chief, Research and Engineering Division

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